Cassini Radar/Radiometer and VLA Observations of Jupiter's Synchrotron Emission

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On route to Saturn, the Cassini spacecraft flew past Jupiter and provided the first opportunity to observe the Jovian synchrotron radiation at a wavelength of 2.2 cm. Measurements were successfully carried out near the time of closest approach to Jupiter using the radiometer subsystem of the Cassini Radar Instrument. The resulting data provide unique information on the highest energy electrons in the magnetosphere. Earth-based radio telescopes have difficulty measuring the synchrotron radiation at wavelengths this short because of the difficulty in separating atmospheric thermal emission from the synchrotron radiation, which becomes relatively weak at wavelengths shorter than ~ 6 cm. The 2.2-cm radiometer was used to produce 20 maps covering two complete rotations of Jupiter in both horizontal and vertical linear polarization. Synchrotron emission, although even weaker than anticipated, was clearly detected distinct from the thermal emission as evidenced by its polarization and spatial distribution.

At the same time as the space observations, we conducted a ground-based campaign (Cassini-JMOC) to observe the synchrotron radiation at a variety of wavelengths using the VLA (operating at 20 and 90 cm) and the NASA's Deep Space Network antennas (operating at 2.3, 8.5, 13.8, and 32 GHz). We anticipate that by combining these data and incorporating previous ground based measurements (6, 13 and 20 cm), we will obtain a much more complete picture of the energy spectrum and distribution of relativistic electrons trapped in Jupiter's radiation belts. Results from the Cassini Radar instrument and the VLA will be presented towards this goal.

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